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Forest management in Europe and its local effect on land surface temperature (LST) – broadleaf tree cooling vs. dense forest cooling

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Forest management (FM) can help to mitigate climate change by altering biogeochemical and biophysical processes at the earth surface. However, the biophysical climate effects of FM are not yet sufficiently understood and decision-makers lack scientific evidence when designing sustainable FM strategies. To enhance our understanding of the biophysical climate effect of FM, we used two LST datasets over Europe (MODIS, LSA SAF) derived from satellite remote sensing observations. We assessed the link between spatial patterns of LST and spatial patterns of forest structure and forest type, which can be related to different FM strategies.
Our results show that the two management strategies of increasing tree cover density and broadleaf tree fraction provide local cooling during the day in summer. During nights and in winter both FM strategies mainly cause warming. During the day an increased broadleaf tree fraction seems to provide cooling in the afternoon, while an increased tree cover density provides largest cooling at around noon. In mediterranean forests, the summer cooling caused by an increased tree cover density is more than two times higher than the one caused by an increased broadleaf tree fraction. In the boreal forest both strategies provide a cooling of similar magnitude. In boreal and alpine forests an increase in tree cover density and broadleaved tree fraction leads to an increase in yearly mean temperatures. However, for all regions we observe a reduction in maximum temperatures in summer and potentially during heatwaves.